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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,067	10/31/2003	Dhruva Ranjan Chakrabarti	200312985-1	1366

22879 7590 07/02/2007

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
STEELMAN, MARY J	
ART UNIT	**PAPER NUMBER**
2191	

MAIL DATE	DELIVERY MODE
07/02/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/699,067	CHAKRABARTI ET AL.	
	Examiner	Art Unit	
	MARY STEELMAN	2191	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to Remarks and Amendments received 03/27/2007. Per Applicant's request, claims 1, 2, 3, 4, 9, and 10 are amended. Claims 1-17 are pending.

Information Disclosure Statement

2. IDS received 10/31/2003 has been considered.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. In view of the amendments to claims 9 & 10, the prior 35 U.S.C. 101 rejections are hereby withdrawn.

Response to Arguments

5. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject

matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived y the manner in which the invention was mad

7. Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,740,443 to Carini, in view of "Profile Guided Automatic Inline Expansion for C Programs", by Pohua P. Chang, Scott A. Mahlke, William Y. Chen, and Wen-Mei W. Hwu (1991) (hereinafter Chang).

Per claims 1, 9, and 17:

A method of cross-file inlining during a compilation of a program, the method comprising determining which files to open and close based on affinity weightings between the files, wherein the affinity weightings depend on a number of potential inlines between the files.

Carini disclosed (col. 6: 23-34, locality and dependence considerations for inline analysis. Carini disclosed (col. 6: 13) cross file inlining, determined by Interprocedural Analysis and construction of a call graph (col. 7: 50-51), and a calculation of a 'routine cost function' and a 'call site cost function' to characterize the suitability of each call site for inlining (potential inlines between files). The 'inline transformation order' is made by (col. 9: 1-2) a backwards walk of the interprocedural analysis of the program control graph.

Carini failed to disclose determining which files to open and close based on affinity weightings between the files, wherein the affinity weightings depend on a number of potential inlines between the files. However, Chang disclosed (p. 353, 2nd – 5th paragraphs) weighted call graph, comprised of nodes, arcs, and weights related to the number of invocations of the function by all callers. Chang disclosed (p. 356) 'hazard detection and prevention' used in determining which files to open and close based on affinity weightings. Chang disclosed (p. 358, 2nd paragraph) "selecting the function calls for expansion and actually expanding these functions. The goal of selecting the function calls is to minimize the number of dynamic functions calls subject to a limit on code size increase.

Therefore, it would have been obvious, to one of ordinary skill in the art, at the time of the invention, to modify Carini, using the teaching of Chang, because both references understood the importance of profiling code to better optimize, however, certain features, such as available memory, are an important consideration when deciding whether to open a file to (bottom of p. 353) 'duplicate the callee node, absorbing the duplicated node into the caller node, eliminating the arc from the caller to the callee, and possibly creating some new arcs in the weighted call graph.' Carini also recognized the benefits of profiling code to (col. 2: 46) to select the call sites which should be inlined.

Per claims 2 and 10:

A method of compiling a computer program from a plurality of files of source code, the method comprising:

-an inline analysis to determine which call sites in the plurality of files to inline;

Carini: col. 6: 14, inlining of procedures which are in different source files for the call sites that invoke them, col. 6: 17-34, compiler implemented method for performing selective automatic procedure integration over a program call graph...col. 7: 42-43, both intra-file and inter-file cross file inlining and cloning are supported.

-an inline transformation to perform said inlining within currently opened files, including determining which files to open and close in dependence on affinity weightings between the files.

Carini: Col. 8: 1, Routine cost function include measurements of the size of the procedure, complexity, number of calls, and number of I/O calls (opening and closing files).

Chang disclosed (p. 353, 2nd – 5th paragraphs) weighted call graph, comprised of nodes, arcs, and weights related to the number of invocations of the function by all callers. Chang disclosed (p. 356) 'hazard detection and prevention' used in determining which files to open and close based on affinity weightings. Chang disclosed (p. 358, 2nd paragraph) "selecting the function calls for expansion and actually expanding these functions. The goal of selecting the function calls is to minimize the number of dynamic functions calls subject to a limit on code size increase.

Therefore, it would have been obvious, to one of ordinary skill in the art, at the time of the invention, to modify Carini, using the teaching of Chang, because both references understood the importance of profiling code to better optimize, however, certain features, such as available memory, are an important consideration when deciding whether to open a file to (bottom of p. 353) 'duplicate the callee node, absorbing the duplicated node into the caller node, eliminating the arc from the caller to the callee, and possibly creating some new arcs in the weighted call graph.' Carini also recognized the benefits of profiling code to (col. 2: 46) to select the call sites which should be inlined.

Per claims 3 and 11:

-affinity weightings are representable by an inline affinity graph whose nodes correspond to files and whose edges correspond to potential inlines across corresponding files.

Carini: Col. 7: 53-66, The compilation model provides an IPA collection phase during which each procedure in the program is visited and the IPA inputs are collected...a routine cost function to characterize the suitability of each procedure for inlining and a call site cost function to characterize the suitability of each call site for inlining., col. 8: 9-15, construction the program call graph, inlining inputs are collected and an intermediate representation is generated.

Per claims 4 and 12:

-the affinity weightings between files depend at least upon the number of potential inlines between the files.

Carini: Col. 8:1, col. 10: 47, Each outgoing edge of each procedure is visited...inlining is performed on edges that have been marked 'INLINE and the corresponding call sites within the procedure are removed.

Per claims 5 and 13:

-dynamically updating the inline affinity graph after inlinings within currently opened files are done.

Carini: Col. 8:1, col. 10: 47, Each outgoing edge of each procedure is visited...inlining is performed on edges that have been marked 'INLINE and the corresponding call sites within the procedure are removed. (dynamically updating), col. 9: 10, Perform optimizations and transformations.

Per claims 6 and 14:

-an inline dependence for a call site is maintained including information as to a set of call sites that the call site depends upon.

Carini: Col. 10: 16 & 24-29, each procedure is visited, measurements of the size of the procedure, complexity, number of calls, and number of I/O calls for each procedure.

Per claims 7 and 15:

-inline dependencies are representable by an inline dependence graph.

Carini: col. 7: 49-60, Collect the Interprocedural Analysis (IPA) inputs. Construct the program call graph (PCG). Perform a reverse topological traversal of the PCG...intermediate

representation of the procedure...Also collected and saved during thhis phase are the inlining and cloning inputs...

Per claims 8 and 16:

-dynamically updating the inline dependence graph after inlinings within currently opened files are done.

Carini: Col. 9: 10, Perform optimizations and transformations.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Note:

USPN 7,146,606 B2 to Mitchell et al.

Mitchell disclosed (col. 2: 42-49) an intermediate representation format that can accommodate annotations by threading control flow and data flow graphs through the intermediate representation. Col. 9: 42-49, annotating the IR. Separate data structures may be desired in some instances. Col. 10: 46-47, links are made from branches…to destinations. Col. 10: 57-58, 61-64, more than one path to a label is possible, multiple links can be represented. Control flow can be explicitly represented and expressed in the intermediate representation.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Steelman, whose telephone number is (571) 272-3704. The examiner can normally be reached Monday through Thursday, from 7:00 AM to 5:30 PM If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wei Zhen can be reached at (571) 272-3708. The fax phone number for the organization where this application or proceeding is assigned: 571-273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mary Steelman

06/18/2007

Mary Steelman
Primary Examiner